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MEMBER PROFILE

National Ready Mixed Concrete Association

Founded in 1930, the National Ready Mixed Concrete Association (NRMCA) is the leading advocate for the ready mixed concrete industry. Its mission is to responsibly represent and serve the entire ready mixed concrete industry through leadership, promotion, education, and partnering.

NRMCA's sister organization, the RMC Research & Education Foundation (RMCREF), has been long-represented within TERRA. RMCREF funds and distributes cutting-edge research, including the work being performed at the MIT Concrete Sustainability Hub, as well as a host of other universities around the world. RMCREF also funds development of industry education programs to promote quality, professionalism, and sustainability in the concrete industry.

More about NRMCA

RESEARCH SPOTLIGHT

Durable Roads program helps Norway improve service life and reduce costs

For many years, there has been a growing need in Norway for improved expertise in road technology. Many older roads need reconstruction or strengthening, and premature failures are occurring too often on new roads—sometimes because of low-quality work and the improper use of materials. In addition, changes in traffic loading, climate, and materials, as well as in production methods and equipment, have made it necessary to revise current guidelines.

The Norwegian Public Roads Administration (NPRA) launched the Durable Roads program in 2011. The goal of the four-year research program, which wrapped up in 2014, was to achieve increased pavement service life and reduced annual cost for the Norwegian road network. The program focused on three main topic areas: road surfacing, structural design and strengthening, and knowledge dissemination and implementation.

More about Norway's Durable Roads program

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News briefs about TERRA and its members

- MTE's Reinke receives Rohrbach Award
- CP Tech Center develops innovative approach for proportioning concrete mixtures
- TERRA survey on cure time for cold-recycled and full-depth-reclamation mixtures yields recommendations
- Taylor appointed CP Tech Center director

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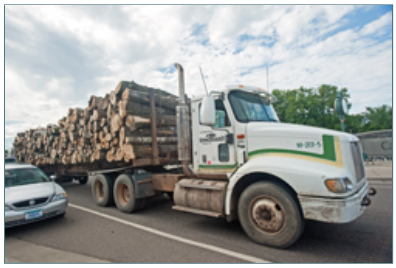
TERRA Pavement Conference highlights growing freight shipments and the roads that carry them

What is being hauled—and how—makes a big impact on our road network. Railroads may account for

the biggest share of freight ton-miles nationally, but trucks actually carry the majority of freight when measured in tons or the number of trips.

"How do we get the data needed to really understand how trucks are impacting our roads—data on truck weight in particular?" asks Maureen Jensen, with the MnDOT Office of Freight and Commercial Vehicle Operations.

More about the 2015 TERRA Pavement Conference



MnROAD research benefits

An upcoming report about the MnROAD Phase Two initiative will compare annual average costs for MnROAD ($2.75 million for research, salaries, and more) to savings and benefits ($10.3 million per year).

More about MnROAD research

New microsurfacing specifications improve cold-temperature performance of asphalt pavements

Agencies throughout Minnesota started using microsurfacing on a larger scale in the 1990s to fill ruts and smooth surfaces on high-volume roads. In cold temperatures, the mix becomes more brittle, which can increase the likelihood of cracking. In addition, snowplow damage has been noted on microsurfaced roads. These issues resulted in research and new projects to enhance its effectiveness in colder climates. The research activities also are the basis for a new TERRA fact sheet about new microsurfacing specifications improving the cold-temperature performance of asphalt pavements.

More about new microsurfacing specs for cold climates

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Event notices from TERRA, its members, and friends

- CTS Transportation Research Conference scheduled for May 20–21
- Concrete overlay project open house, May 21
- MAPA upcoming events

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RESEARCH ROUNDUP

Recently published reports about road research focusing on cold climates

- Modeling Multimodal Freight Transportation Network Performance under Disruptions
- Development, Field Testing, and Implementation of Improved Bridge Parapet Designs
- Ground Penetrating Radar Evaluation of New Pavement Density

Read more

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NRMCA and RMCREF were brought into TERRA by their partner, the Aggregate and Ready Mix Association of Minnesota. ARM is a founding member of TERRA. RMCREF executive director Julie Garbini and NRMCA vice president for pavement structures Brian Killingsworth represent NRMCA on the TERRA General Assembly.

"At the time, NRMCA and RMCREF were attracted by the opportunity to work more closely with MnROAD due to its unique capabilities as a research entity," Garbini said. "The industry was able to co-fund pervious concrete research at MnROAD, as facilitated by the TERRA partnership. The collaboration with academic, state DOT and other industry partners has been key to the organizations staying involved and seeing value in TERRA, in addition to the continued relationship with MnROAD."

NRMCA and RMCREF priorities remain centered around research that will enhance concrete quality, durability, sustainability and cost-effectiveness. One of the biggest challenges concerning pavement and infrastructure has been transferring research into practice.

"We are pleased with TERRA's renewed focus on research implementation," Garbini added. "While we need to continue cutting-edge research and there is always more to learn, there is a lot of work that has already been done that isn't being used in the field."

Applying research that supports new applications, design, and practices, she said, is the key to advancing sustainability in the transportation industry and can help address some of the financial challenges faced by municipalities, states, and federal transportation owners.

"We need to think in a longer-term way about our infrastructure design and financing," Garbini concluded. "Research implementation is one way to start changing our short-term mindsets. Another challenge is overly prescriptive specifications, which are sometimes limiting the opportunities to implement sound research and practices. Allowing for performance-based specifications will promote innovation and allow more to be done with less."

NRMCA also has an engineering division, which supports industry professionalism and quality, provides technical advocacy in codes and standards, promotes the use of performance-based specifications, conducts concrete research, develops technical publications, coordinates technical education, and develops ideas and provides technical consultation for technical research and education.

In addition, NRMCA provides a host of resources for architects, engineers and developers, including research and technical guidance, project and planning resources, and a free design assistance program.

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RESEARCH SPOTLIGHT

Durable Roads program helps Norway improve service life and reduce costs

The Norwegian Public Roads Administration provided details about this edition's featured research project.

Problem

For many years, there has been a growing need in Norway for improved expertise in road technology. Many older roads need reconstruction or strengthening, and premature failures are occurring too often on new roads—sometimes because of low-quality work and the improper use of materials. In addition, changes in traffic loading, climate, and materials, as well as in production methods and equipment, have made it necessary to revise current guidelines.

Solution

The Norwegian Public Roads Administration (NPRA) launched the Durable Roads program in 2011. The goal of the four-year research program, which wrapped up in 2014, was to achieve increased pavement service life and reduced annual cost for the Norwegian road network. The program focused on three main topic areas: road surfacing, structural design and strengthening, and knowledge dissemination and implementation.

Results of the program include new guidelines for asphalt pavement compaction. (Photo: Marit Fladvad)

Over time, program results will help improve quality of service and accessibility for users, which in turn will lead to a reduction in crash-related costs, travel time costs, and vehicle operating costs. Longer service life could also mean fewer traffic delays and reduced monitoring costs.

Implementation

Results of the Durable Roads program have led to updated or new guidelines for compaction, frost protection, use of recycled concrete, asphalt paving, pavement rehabilitation, and control of asphalt works. The program also developed new quality control methods and performance requirements for selected surfaces.

Durable Roads also focused on getting information about road technology into the hands of practicing professionals and students interested in road engineering. This included writing a new textbook in road technology for use at colleges and universities as well as conducting and contributing to training courses for professionals.

The goal of Durable Roads is to increase the service life of Norwegian roads. Improved quality in road construction leads to reduced costs for both the road owner and users. (Photo: Knut Opeide)

Project Partners

The Durable Roads program was conducted in cooperation with the regional offices of the NPRA, contractors, suppliers, the Norwegian University of Science and Technology (NTNU) and other colleges, other Nordic transport authorities, research institutes, and consultants.

More Information

- Contact Durable Roads program leader Leif J. Bakløkk

Each TERRA member organization has an opportunity to briefly share and showcase a specific research project or initiative in the Member Research Spotlight. Those previously published here remain available through the TERRA E-News archives.

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MEMBER HIGHLIGHTS

News briefs about TERRA and its members

MTE's Reinke receives Rohrbach Award


Gerry Reinke

Gerry Reinke, president of Mathy Technology and Engineering Services (MTE), received the Gerald Rohrbach Distinguished Service Award at the 2015 TERRA Pavement Conference in February. Reinke joined Mathy Construction in 1991 as technical director, and he has served as president of MTE since it became a Mathy subsidiary in 1993. In 2007, a team of Reinke, Steve Engber (also with MTE), and Gaylon Baumgardner (Paragon Technical Services), MTE developed the first U.S. application of warm-mix asphalt that did not require water, wax, or foaming. This gave birth to what is probably the most widely used warm-mix modifier in the country. In 2013, implementing a research study developed by Reinke, Dunn Blacktop constructed shoulder test sections on U.S. 14 using high binder-replacement levels of reclaimed asphalt pavement and shingles (RAP and RAS).

CP Tech Center develops innovative approach for proportioning concrete mixtures

National Concrete Pavement Technology Center at Iowa State University published a report in March describing an innovative, performance-based approach to proportioning concrete mixtures. It is intended to provide guidance for concrete producers, specifiers, contractors, and engineers. Mixture proportioning routinely has been a matter of using a recipe based on a previously produced concrete rather than adjusting the proportions based on the needs of the mixture and the locally available materials. But as budgets have grown tighter and increasing attention is being paid to sustainability metrics, greater focus is being placed on making mixtures that more efficiently use materials without compromising engineering performance. The proposed method is intended to be user-friendly, easy to apply in practice, and flexible in terms of allowing a wide range of material selection. The report provides step-by-step instructions to guide the selection of required aggregate and paste systems based on the performance requirements. In addition, though the provided guidance in this report is primarily for concrete pavements, a similar approach can be applied to other concrete applications.

Download the report (1.7 MB PDF)

TERRA survey on cure time for cold-recycled and full-depth-reclamation mixtures yields recommendations

A recent TERRA ad hoc task force survey of agencies, suppliers, and contractors examined methods and procedures used to determine when a cold-recycled (CR) and full-depth-reclamation (FDR) mixture has cured sufficiently to allow placement of a surface course. As a result, the Asphalt Recycling & Reclaiming Association (ARRA) has published best practice guidelines for cold in-place (CIR) and bituminous stabilized FDR using emulsified and foamed asphalt. For CIR, ARRA recommends that the recycled pavement layer should be allowed to cure for a minimum time (typically three days) and to a maximum moisture content (typically below 3 percent) before placing the surface course or applying secondary compaction. If the moisture content does not fall below the maximum limit and if the roadway has been free of rain for a specified amount of time (typically anywhere from 2 to 10 days), the contractor should be allowed to place the surface course or perform secondary compaction. Traffic is usually allowed on the mat during this time. For FDR, ARRA recommends either the above criteria or that the moisture content be less than 50 percent of the optimum moisture content determined from a modified Proctor test on the field-produced FDR mixture. In addition, a revised Basic Asphalt Recycling Manual (BARM), which is currently being printed, will be available for order online from ARRA. Also available online are ARRA best practice

guidelines.

Taylor appointed CP Tech Center director

Peter Taylor has been appointed director of the National Concrete Pavement Technology Center at Iowa State University. He replaces Tom Cackler, the director since 2003, who is retiring. Taylor has been the associate director of CP Tech Center since he joined the organization in 2007. As associate director, he has been involved in managing and conducting research projects and programs investigating materials-related aspects of concrete pavements and in teaching applied concrete materials technology to practicing engineers. He is a research associate professor in the ISU Department of Civil, Construction, and Environmental Engineering.

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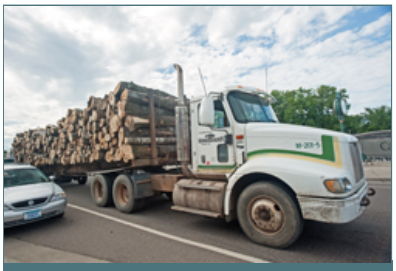

Photo by David Gonzalez, MnDOT

"How do we get the data needed to really understand how trucks are impacting our roads—data on truck weight in particular?" asks Maureen Jensen, with the MnDOT Office of Freight and Commercial Vehicle Operations. "That's especially important if we're going to have bigger, heavier trucks. The data we have tells us axle violations are more common than gross weight violations. With bigger trucks and less-experienced drivers, will that increase?"

Jensen, longtime manager of road research with the MnDOT Office of Materials and currently on special assignment with the freight office, was a featured speaker at the 19th annual TERRA Pavement Conference on February 12 in St. Paul. She discussed state and national issues related to freight and shared early findings from a low-volume road study at MnROAD.

Sharing 2012 data from the FHWA Freight Analysis Framework, Jensen described what is being hauled in Minnesota. Agricultural products and other foodstuffs account for a little more than one-third of all freight. Raw materials such as metallic minerals, coal, and gravel make up another 27 percent, not including current levels of crude oil. She also showed freight tonnage predicted for 2040. For example, cereal grain shipments are projected to grow from 149,000 tons in 2012 to 268,000 tons in 2040, and coal and animal feed tonnage is projected to nearly double.

Jensen pointed to several pavement-related issues that affect the bottom line for trucking companies and, in turn, the public. Rough pavements, for example, damage goods and increase fuel consumption. And smooth freight flows are interrupted by inconsistent size and weight restrictions among states, between the state of Minnesota and local jurisdictions, and among the local jurisdictions.

In that vein, Jensen also described the first phase of a study on the low-volume loop at MnROAD. "We looked at what happens when you run an 80,000-pound truck and a 102,000-pound truck on separate lanes, keeping the equivalent single-axle loads (ESALs) the same. You might be surprised to learn," she said, "that the more frequent loading by the 80,000-pound truck led to more fatigue cracking, faulting, and rutting. We didn't see any difference in ride or low-temperature cracking. So even though we like to talk about ESALs, we really need to look at load spectra. What's on each of those axles and how many times are they going over the pavement?"

Besides Jensen, the conference also featured Buzz Powell, assistant director and test track manager of the National Center for Asphalt Technology (NCAT). Powell discussed highlights of the NCAT/MnDOT partnership launched this year. The partnership will make use of the MnROAD facility near Albertville, Minnesota, and the NCAT pavement test facility at Auburn University in Auburn, Alabama. Research will focus on quantifying the benefits of various pavement preservation techniques and the selection of the proper HMA-performance test for different cracking modes. Powell also gave a concurrent session presentation about the NCAT test track and current projects.

In other sessions, John Staton, concrete operations and materials engineer with the Michigan DOT (a TERRA member), reported on the department's efforts to achieve cast-in-place rapid-setting concrete mixtures that are cost-effective, user-friendly, and durable. Lab- and field-testing have yielded early results; additional work will include field tests via the state's preventive maintenance program.

Steve Cross, technical director of the Asphalt Recycling & Reclaiming Association (ARRA), shared findings from a recent TERRA survey (see related item) and gave an update on new ARRA publications. New publications include a series of best practice guidelines and the second edition of the *Basic Asphalt Recycling Manual* (FHWA–HIF-14-001).

The event, sponsored by TERRA in cooperation with a number of organizations, attracted representatives from state and local agencies, consultants, and industry, primarily from the Upper Midwest.

A special half-day MnROAD Workshop held the day before the conference showcased MnROAD Phase Two benefits (see related item). The workshop focused on products and advancements developed through MnROAD research. Speakers included members from industry, other states, and MnDOT.

Slides from most 2015 TERRA Pavement Conference presentations are available for download on the TERRA website. In addition, detailed summaries of selected sessions will be available in the spring and summer issues of the Minnesota LTAP *Technology Exchange* newsletter.

Related resources:

- 2015 TERRA Pavement Conference event web page
- 2015 TERRA Pavement Conference stories (Minnesota LTAP *Technology Exchange*)
- 2015 MnROAD Workshop agenda and presentations
- MnROAD and NCAT partnership
- Asphalt Recycling & Reclaiming Association

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PROJECTS AND INITIATIVES

MnROAD research benefits

Initial research (Phase One, from 1994 to 2006) at the Minnesota Road Research Project, known as MnROAD, resulted in projects leading toward lower construction costs, shorter construction times, and improved pavement performance, according to MnROAD operations engineer Ben Worel. Minnesota alone saves an estimated $33 million each year thanks to quantifiable advances made during the Phase One initiative.

MnROAD

In Phase Two (2007–2016), almost 40 MnROAD test cells were reconstructed for more than 20 different studies. The benefits derived from this effort again outweighed the investments in the research even when calculating only the benefits to the State of Minnesota. In fact, the Phase Two initiative achieved a benefit-to-cost ratio of more than 3-to-1—not including the savings from the other 16 state agencies involved with the studies.

A Phase Three initiative at MnROAD is planned to begin this year and will run through 2026. Partnerships among TERRA members as well as other government agencies, academia, and industry are being developed to support these efforts.

An upcoming report about the MnROAD Phase Two initiative will compare annual average costs for MnROAD ($2.75 million for research, salaries, and more) to savings and benefits ($10.3 million per year).

Specific annual savings attributable to Phase Two research at MnROAD:

- *Whitetopping*: $1.9 million (thinner concrete overlay designs)
- *Low-temperature cracking*: $2.3 million (better performance, reduced cracking, less maintenance)
- *Stable and drainable* base materials: $4.7 million (reduced deterioration of HMA cracks and PCC joints)
- *Recycled unbound materials*: $0.8 million (more sustainable material selection vs. virgin materials)
- *Full-depth reclamation*: $0.5 million (proven rehabilitation design and life-extending benefits)
- *Stabilization using high-carbon fly ash*: $0.1 million (insurance for construction delays)

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PROJECTS AND INITIATIVES

New microsurfacing specifications improve cold-temperature performance of asphalt pavements

When high-speed roadways in Europe began to experience wheel rutting, transportation practitioners turned to microsurfacing as a solution. In the 1980s, microsurfacing attracted interest in the United States as a maintenance treatment for pavement.

Minnesota Trunk Highway 64 (Morrison County, Minnesota)

Agencies throughout Minnesota started using microsurfacing on a larger scale in the 1990s to fill ruts and smooth surfaces on high-volume roads. In cold temperatures, the mix becomes more brittle, which can increase the likelihood of cracking. In addition, snowplow damage has been noted on microsurfaced roads. These issues resulted in research and new projects to enhance its effectiveness in colder climates. The research activities also are the basis for a new TERRA fact sheet about new microsurfacing specifications improving the cold-temperature performance of asphalt pavements.

Microsurfacing consists of both developing the microsurfacing material and applying it to the road surface. Microsurfacing material combines fine, dense-graded aggregate—typically performance grade (PG) 64-22 asphalt cement (AC) as the base asphalt—with polymer-modified asphalt emulsion, water, polymer, mineral filler, and field additive.

The semi-liquid mixture then is applied in thin layers, usually through the use of specialized mixing and paving equipment, to serve as the wearing course on a roadway. It changes from semi-liquid material to a dense cold-mix material that can carry normal traffic within several hours of application.

Microsurfacing offers advantages as a surface treatment tool for high-volume roads, such as filling ruts and correcting minor surface irregularities, reducing future oxidation, slowing further aging of the underlying asphalt pavement, decreasing raveling of the underlying asphalt pavement and reducing water infiltration, improving skid resistance, and managing the life-cycle costs of a pavement.

The microsurfacing material cures quickly on the road after application, which allows agencies to work at night and keep road closure times to a minimum. Both the quality of the material development and its application are important to ensuring benefits from the use of microsurfacing.

In 2005, the Minnesota Road Research Project (MnROAD) began research to explore whether changes to the mix of the microsurfacing material might improve its on-the-road performance in cold temperatures. The research helped pave the way for several recent projects and development of a new specification.

In 2012, the Minnesota Department of Transportation (MnDOT) completed a microsurfacing project on a MnROAD test section. After two years, the road is showing improved cold-temperature performance while maintaining strength. Based on the results of this and other projects, MnDOT has changed its microsurfacing specification to incorporate the softer base. Currently, the specification is part of MnDOT special provisions and will be included in the new specification book scheduled for publication in 2016.

MnDOT has begun to share the results of this study nationally, including a presentation at the International Slurry Seal Association (ISSA) conference in January 2015. MnDOT plans to continue expanding the use of microsurfacing projects with the PG 58-28 base asphalt and evaluating completed projects.

Related resources:

- Download the new TERRA fact sheet on microsurfacing
- "Flexible Slurry–Microsurfacing System for Overlay Preparation: Construction and Seasonal Monitoring at Minnesota Road Research Project"
  (*Transportation Research Record*, June 2007)
- International Slurry Seal Association
- Contact MnDOT expert Thomas Wood, 651-366-5573

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CTS Transportation Research Conference scheduled for May 20–21

The 26th Annual CTS Transportation Research Conference on May 20–21 at the Saint Paul RiverCentre, Saint Paul, Minnesota, will again include an infrastructure track with pavement-related sessions. The University of Minnesota Center for Transportation Studies conference acts as a forum for researchers and practitioners from Minnesota and the Upper Midwest to share their research findings in a variety of transportation-related areas. The conference audience consists of individuals from multiple disciplines and organizations involved in transportation, including policymakers and practitioners from state, regional, and local government; private sector consultants, shippers, carriers, and providers; and faculty, students, and staff from the University of Minnesota and other educational institutions.

Concrete overlay project open house, May 21

An open house on May 21 in Dassel, Minnesota, will showcase a 15-mile long, 4-inch thick bonded concrete overlay of asphalt (BCOA) project completed last year on Trunk Highway 24 near Litchfield, Minnesota. The primary goals are to share lessons learned during the construction of the project and to visit the project site to review its performance after its first winter of service. The event is sponsored by TERRA, the Minnesota Department of Transportation, the Federal Highway Administration, and CP Tech Center (Iowa State University). A flier and registration form are available for download from the TERRA website (307 KB PDF).

MAPA upcoming events

The Minnesota Asphalt Pavement Association (MAPA) calendar includes these upcoming events:

- MAAPT 62nd Annual Asphalt Conference
  December 9, 2015
  DoubleTree by Hilton Hotel, Minneapolis, Minnesota
- MAPA 62nd Annual Membership Meeting
  December 10 - December 11
  DoubleTree by Hilton Hotel, Minneapolis, Minnesota

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RESEARCH ROUNDUP

Recently published reports about road research focusing on cold climates

- *Modeling Multimodal Freight Transportation Network Performance under Disruptions*
  (10.9 MB PDF, Mid-Atlantic Transportation Center, March 2015)
  This report develops a multimodal freight transportation network to simulate commodity movements, evaluate the impacts of disruptions, and develop effective emergency operation plans.
- *Development, Field Testing, and Implementation of Improved Bridge Parapet Designs*
  (2.3 MB PDF, Ohio Department of Transportation, March 2015)
  This report evaluates different approaches to address premature bridge cracking through use of test parapets.
- *Ground Penetrating Radar Evaluation of New Pavement Density*
  (2.2 MB PDF, Washington DOT, February 2015)
  This report maps pavement surface density variations using dielectric measurements from ground penetrating radar.
- *Cracking Behavior of Structural Slab Bridge Decks*
  (7.0 MB PDF, Ohio Department of Transportation, January 2015)
  This report discusses the cracking behavior of continuous span structural slab bridges in order to address bridge deck cracking issues and the service life of concrete bridges.
- *North Dakota Implementation of Mechanistic-Empirical Pavement Design Guide (MEPDG)*
  (3.9 MB PDF, Mountain-Plains Consortium, December 2014)
  This report summarizes the findings of mechanistic-empirical pavement design (MEPDG) implementation and identifies input data needs and research steps of MEPDG implementation.
- *Analysis of Aggregate Pier Systems for Stabilization of Subgrade Settlement*
  (14.0 MB PDF, Ohio Department of Transportation, December 2014)
  This report investigates the applicability of vertical column support systems to improve subgrade and reduce settlements for existing roadways in Ohio.
- *Guidance for Improving Foundation Layers to Increase Pavement Performance on Local Roads*
  (3.2 MB PDF, CP Tech Center, November 2014)
  This report considers how to optimize local pavement foundation support layers in order to understand overall pavement performance.

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